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How to reduce piping inventory

Piping represents a significant part of the plant cost, ranging from 15%–25%.[1] Materials stored in warehouses or storage facilities cost companies in terms of personnel, materials, time, space, insurance, risk, etc. This article proposes cost-saving strategies for inventory reduction. Further, it emphasizes consistent naming conventions to avoid creating duplicate/redundant items.

Piping inventories can be reduced considerably in the following three categories.

1. Small-sized (< 3 in.) flanges, flanged fittings/valves and spiral-wound gaskets
2. Reinforced branch connection/olets (weldolets, threadolets, sockolets)
3. Ring-type joint gaskets.

Category 1 has the biggest potential for considerable cost savings and will be discussed in detail. Some operator companies will be familiar with Categories 2 and 3; these will be discussed briefly for the benefit of knowledge-sharing in the oil and gas industry.

Small-sized (< 3-in.) flanges, valves and gaskets. Many operator companies maintain separate inventory for ASME Class 300 and Class 600 flanges, flanged valves and gaskets for 0.5-in.–3-in. pipes. It is proposed to use only class 600 flanges, flanged valves and gaskets for 0.5-in.–3-in. pipes This can be considered an "over-design," but there is a minimal financial or delivery impact of this change due to the small size.

Reason/rationale: For 0.5-in.–3-in. pipes, the pitch circle diameter (PCD), number and size of hole diameter exactly match for Class 300 and Class 600 flanges. See Examples 1 and 2 in **TABLE 1.** Please note that the cost difference of $120 in Example 2 (even with a 33% higher price) is insignificant/minor for refinery or petrochemical plants in an emergency/shutdown situation. If holding (or carrying) cost, ordering cost and minimum stock level of each class are considered, it is advisable/recommended to maintain inventory of single (Class 600) flanges/valves, which are suitable for both situations.

As seen from **TABLE 1** and **FIG. 1,** Class 300 and Class 600 flanges/flanged valves are dimensionally similar (except for flange thickness or valve face-to-face dimensions, which require a longer bolt). So, Class 300 flanges/valves can be replaced by Class 600 flanges/valves in relevant piping material classes. This concept can be extended to other flanged components, such as nipoflanges, spectacle blinds and y-strainers.

Caution: This concept is not applicable to existing plants (or tie-in locations), where separate inventories are maintained for Class 300 and Class 600 flanges. For example, a Class 300 valve cannot be replaced by a Class 600 valve due to longer face-to-face dimensions. However, for major modification projects where new equipment/piping is installed

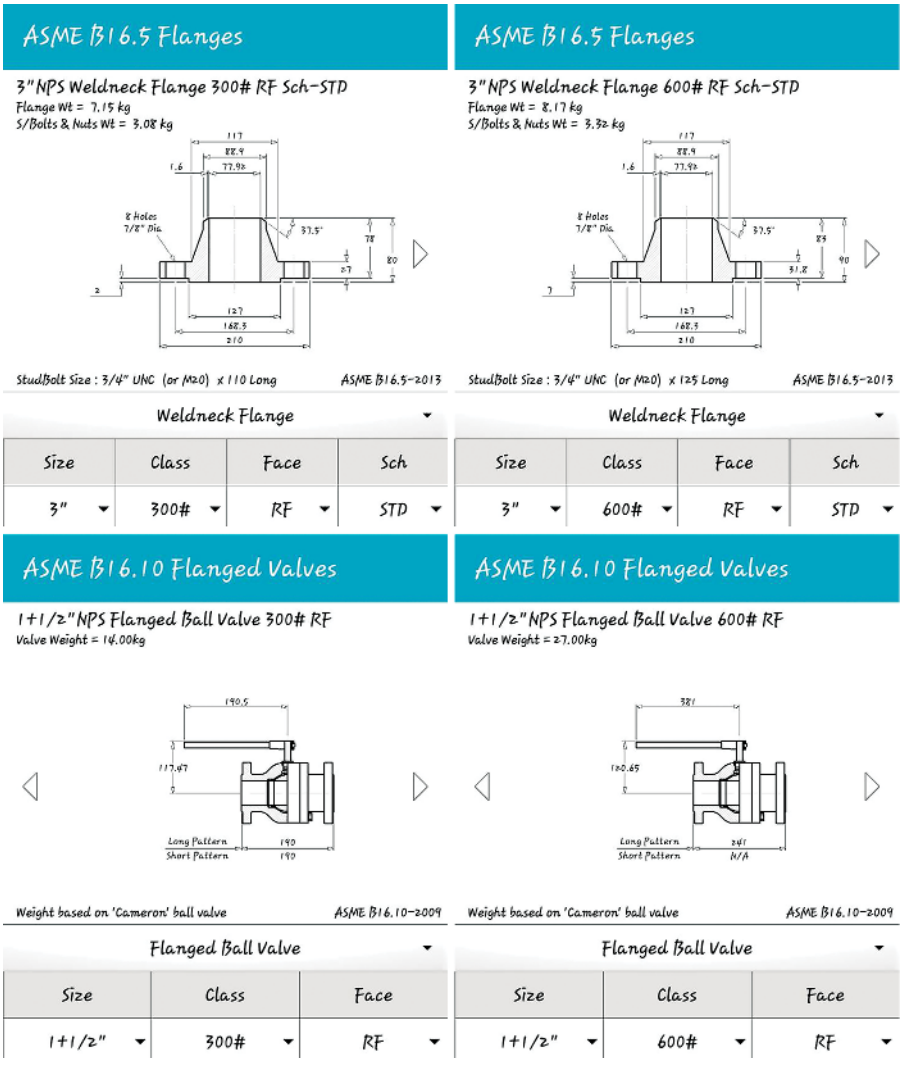

FIG. 1. Comparison of Class 300 and Class 600 flanges and valves.[5]

TABLE 1. Comparison of Class 300 and Class 600 flanges and valves [2,3,4,5]

	Example 1		Example 2	
	3-in. Class 300 WN flange RF	3-in. Class 600 WN flange RF	1.5-in. Class 300 ball valve RF	1.5-in. Class 600 ball valve RF
	Matl: A-105	Matl: A-105	Matl: A352 LCC	Matl: A352 LCC
PCD, mm	168.3	168.3	114.3	114.3
Number of holes	8	8	4	4
Bolt size, in. x mm	0.75 × 110	0.75 × 125	0.75 × 90	0.75 × 110
Spiral-wound gasket (ID/OD), mm	81/149.4	81/149.4	44.5/95.3	44.5/95.3
Flange raised face thickness, mm	80	90	–	–
Valve dimensions face-to-face, mm	–	–	190	241
Weight, kg	7.15	8.17	14	27
Price, $U.S.	20	29	360	480

TABLE 2. Suggested nomenclature notes to reduce inventory

Incorrect description	Correct description
Oval ring gasket, 1-in. Class 1500, R16	Oval ring gasket R16 (for 1-in. Class 3/6/9/1500 and 0.75-in. Class 2500 ASME flange)
Oval ring gasket 2-in. Class 900, R24	Oval ring gasket R24 (for 2-in. Class 9/1500 ASME flange and 2 1/16-in. 3/5000 psi API Type 6B flange)
Oval ring gasket 3-in. Class 1500, R35	Oval ring gasket R35 (for 3-in. Class 1500 ASME flange and 3 1/8 in. 5000 psi API Type 6B flange)

in a separate area with a clear physical boundary (e.g., a compression project), this concept of utilizing Class 600 flanges/valves seems feasible if an addenda is issued to existing piping material classes and the client is made fully aware of this change. In offshore installations, this concept should be used with caution due to space and weight constraints.

Recommendation: ASME Class 600 (in place of Class 300) flanges, flanged fittings/valves and spiral-wound gaskets may/should be used for size range 0.5 in.–3 in. This decision must be made during the front-end engineering design (FEED) stage to extract the full advantage of inventory reduction.

Reinforced branch connection/olets.[6] Olets are self-reinforced branch fittings that are used whenever branch connections are required in sizes where reducing tees are unavailable, when the branch connections are of smaller size as compared to header size, or when a tee cannot be accommodated in the piping header. One advantage in using olets over other branch fittings (tees, stub-in, etc.) is that for a particular outlet size, the same fitting can be used on different run pipe sizes without affecting pressure integrity or triggering safety concerns.

Reason/rationale: Olet fittings produced by reputable manufacturers are interchangeable. Each olet fitting is designed to fit a number of run pipe sizes (e.g., an 8-3 × 0.5 3000# threadolet will fit 3-in., 3.5-in., 4-in., 5-in., 6-in. and 8-in. run pipes. When this 0.5-in. fitting is placed on a 3-in. run pipe, it will fit perfectly. When placed on an 8-in. run pipe, there will be a maximum gap of 0.8 mm between the top of the run pipe and the base of the fitting at the crotch. This gap is negligible when welding. Similarly, an 18-12 × 2 STD weldolet is suitable for a 12-in.–18-in. run pipe.

Note/caution: Consistent nomenclature must be established for bill of material (in piping isometric), Piping MTO (material take off), material requisition and material catalogue/master inventory list. For example, as stated above, 3 × ½ 3000# threadolet is dimensionally similar to 8 × ½ 3000# threadolet. The correct description would be 8-3 × ½ 3000# threadolet for these two duplicate items. Young piping engineers/warehouse staff must be educated to avoid creating duplicate SAP material numbers. Every new SAP material number must be thoroughly checked and reviewed by the lead piping engineer or engineering manager.

Recommendation: It is proposed and highly recommended to use consolidated olet sizes to substantially reduce warehouse inventory.

Ring-type joint gaskets. The most widely used type of metallic gasket in the process industries is the ring-type joint, which can be used at elevated pressures and temperatures. Ring-joint gaskets are manufactured to ASME B16.20 and API Specification 6A.[7] The cross-section of the ring can be either oval or octagonal. The following suggested nomenclature notes reduce inventory by removing redundant/duplicate items in a warehouse or storage facility.

Reason/rationale: Ring-type gaskets should be specified by ring number only—rather than size, rating and ring number—as particular ring numbers are a suitable/fit inside various flange ratings. For clarity and information purpose, additional details can be mentioned under remarks or a long description column/heading, as shown in TABLE 2.

Caution: None.

Recommendation: Consistent ordering nomenclature/convention must be established to avoid creating duplicate items/SAP material numbers.

Takeaway. Piping represents a significant portion of plant costs. Considerable piping inventory can be reduced in the aforementioned three categories, in the order of decreasing cost saving potential: small-sized flanges and valves (maximum savings), reinforced branch connections and ring-type gaskets (minimum savings). Further, consistent ordering nomenclature/convention must be established to avoid creating duplicate items/SAP material numbers. This reduces piping inventory, minimizes duplication and facilitates quick sorting of piping component(s) in the field. HP

LITERATURE CITED

Complete literature cited available online at www.HydrocarbonProcessing.com

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